Effect of Inflation on Kenya's Maize Production and Food Security

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ABSTRACT

The aim of this project was to examine the major determinants of Kenya's maize production. These objectives were actualized by evaluating the role of government policies on Kenya's maize production for food security between 1992 and 2022 and examining the relationship between inflation and maize production for food security in Kenya between 1992 and 2022. The food availability decline theory would be instrumental in guiding this study. Time-series secondary data from the World Bank, FAOSTAT, and World Trade Organization (WTO) for the relevant period 1990–2022 was used to do this. Using a correlation research design, the econometric analysis of the time-series data revealed that inflation, unemployment, and eventually gross domestic GDP determined maize production. In the near term, the findings demonstrated that the exchange rate, one period's lag in the exchange rate, and the amount and quantity of maize imports all influence maize production. The results imply that in order to lessen the over-reliance on maize production, macroeconomic conditions should be effectively managed to improve domestic maize production, deter a spike in imports of the grain, and enhance food security in the nation.

Keyword: Economic Growth, Food Security, High Food Price, Inflation, Policies, Price Volatility

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I. INTRODUCTION

The term "food crisis" refers to the worldwide phenomenon of rising and unstable food costs and food insecurity. International prices of a wide range of commodities have risen dramatically since 2003, often more than doubling in a matter of years, sometimes even months. The world's impoverished are particularly concerned about a rise in food prices. Almost everyone in poverty spends a significant amount of their household income on food, and many of them rely on food production for their subsistence (Nyoro, 2019).

Global pricing creates inflationary pressures and is a significant challenge for low-income households without access to social safety nets. Soaring consumer prices are a current global trend that affects advanced, emerging, and developing economies. Increased hunger and malnourishment may worsen the situation of individuals who are already impoverished, as sharp price increases provide few options for substitution and adjustment, particularly for the urban poor (Heady and Fan, 2008). For governments in developing nations, rising food prices present significant policy challenges, allowing local prices to fluctuate in line with intercontinental prices. Governments can also stabilize domestic consumer prices by restricting exports or providing food subsidies, but doing so exacerbates the rise in global food costs and undermines the foundation of a rules-based trade system.

Recent events demonstrate that many nations have opted to return the onus of adjustment to the global market (Lust et al., 2023). Numerous developing nations in Asia, Latin America, and Africa are experiencing this condition—protests against high commodity prices. Sub-Saharan Africa forecasted inflation to reach 12.2% in 2022, following a steady increase since 2020. The rate is estimated to decrease, although it will remain high in the future. In North Africa, prices also increased constantly from 2020 to peak in 2022.

African countries (Tunisia, Egypt, Kenya, and Uganda), and in certain instances, unanticipated revolutions and government changes have occurred, as seen in Tunisia and Egypt, for example (Greenwood & Hanke, 2021).There have also been riots in certain African nations, including Uganda and Cameroon, as a result of high food costs. Africa's inflation rates vary greatly from one country to the next, with some under more pressure than others. According to estimates, Sudan has the continent's highest rate of inflation as of 2022.

Kenya's consumer price index (CPI) increased by 0.19% from the previous month, primarily due to higher prices for food and transportation. For 2023, projections indicated that Kenya's annual average inflation would be

higher than the rate projected in other African countries. The indicator measures price variations in goods and services compared to the same month one year earlier. In February 2022, Kenya's inflation rate stood at 9.2%, as did Tanzania and South Africa's at roughly 8% (Kassy et al., 2021). Changes in Kenya's agricultural output also influence the country's fluctuating food costs. In particular, bad weather conditions impact crop yields, leading to an increase in food prices.

1.1 High food prices in Kenya

As the graph below illustrates, food costs in Kenya have been rising between 2006 and 2010.Compared to the consumer price index (CPI) for non-food items, the food CPI has risen more quickly (figure 1).The past three years have seen a sharp rise in the price of several key foods, including milk, wheat, rice, and corn. Price volatility for the majority of food commodities has coincided with rising food costs.
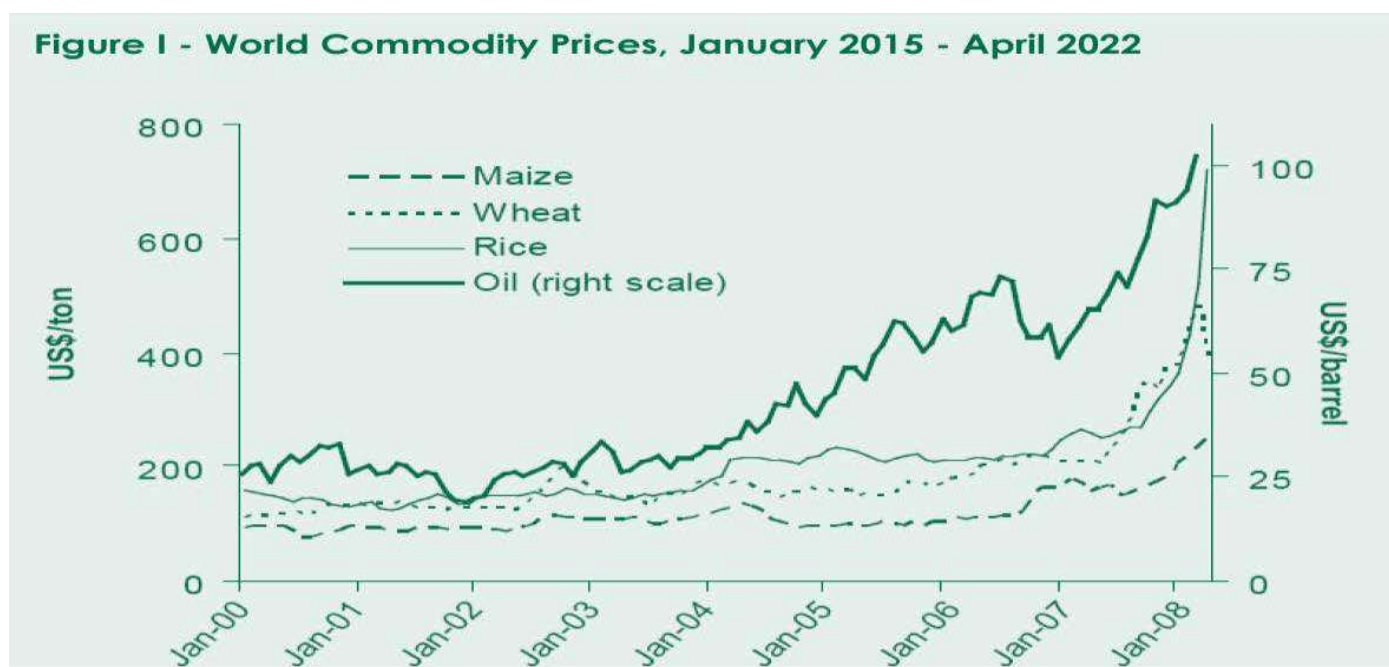

Figure 1
World Community Prices, January 2015-April 2022
Sources: IFPRI (2008)

Prices of food in Kenya have continued to increase despite a decline in world food prices in the first quarter of 2009. The prices of food products like maize in Kenya have remained high, despite a decline in global food prices (Chand, 2010). The cost of maize is extremely high and continues to rise, making food increasingly less accessible to the less fortunate segments of society. Despite the removal of the high import duty on maize in mid-June 2010, we anticipate the private sector to cover the majority of the shortfall. However, the lack of market access to maize, particularly for pastoralists in the region suffering from drought, will necessitate food aid for vulnerable individuals.

Food prices have been high for a while, indicating that Kenyan domestic markets are not receiving enough from international markets (Di Giovanni et al., 2022). The weather, shifts in local output, shocks from illness and consumption, inflation, and changing informal trading patterns are some of the factors that influence local price movement. Rather than being just the outcome of rising production or falling demand, the recent decline in food prices globally seems to be the effect of other economic factors, such as inflation and high interest rates. This implies that the food problem is still present today. A number of important economic reasons, such as financial instability, dysfunctional markets, speculation, and insecurity in certain nations, have also significantly contributed to the crisis in food prices. Research on Kenya's monthly pricing changes reveals this.

Despite a decrease in global pricing, basic foods, including rice, wheat, and maize, have seen price increases. Over the past six months, there have been significant increases in food prices, making it more difficult for millions of Kenyans, particularly the poor and vulnerable groups, to buy food. This is due to a 25% devaluation of the local currency against the US dollar and a 40% increase in fuel prices (Greenwood et al., 2021).

1.2 Overview of Food Security in Kenya

In 1996, the World Food Summit adopted the following definition for food security: "All people, at all times, achieve food security when they have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life (Vos et al., 2022)."

The seminal study by Amartya Sen (Mahmood, 2022) most closely identifies this new emphasis on consumption, the demand side, and the issues of access by vulnerable people to food. Eschewing the concept of food security, he focuses on the rights of individuals and households. The issue of food security has several facets. Hence, the provision of safe, nutrient-dense, and quantitatively sufficient food, as well as universal access to it, are necessary for food security. These are three aspects of food security.

The government and donors provide food aid in sufficient quantities and of high quality through domestic production, commerce, stockpiles, and transfers. Households and individuals can obtain food through production, market purchases, and other modes of exchange, including gifts or bartering. A nutritious meal, uncontaminated water, and sufficient sanitation ensure maximum nutrition intake (Rauch-Mannino, 2022).

When all of these factors are considered, achieving food security in most developing nations, including Kenya, has proven difficult. In Kenya, between two and four million people always need emergency food assistance, while over 10 million people suffer from chronic food insecurity and poor nutrition (Nyoro, 2019). An estimated 1.8 million youngsters (30%) in the country are considered to be chronically undernourished. The country's daily energy consumption per person is below the suggested levels. Even after years of good production, chronic undernutrition (stunting) affects 30% of children. This indicates a long-term, inadequate dietary intake of food, including both macronutrients. This includes inadequate food distribution, especially of high-quality foods; inadequate knowledge about feeding and caring for young children; and recurrent infections (Nyoro, 2019).

1.3 Statement of Research Problem

Given the importance of these goals, the government has taken a number of initiatives to increase Kenya's maize output, seek long-term solutions to eradicate hunger in all of its manifestations by 2030, and ensure food security. However, these initiatives have not significantly increased maize productivity. As a result, the nation has always relied on imports of maize to make up for its lack of production. However, Kenya has not identified the effects of maize importation on consumer and producer welfare. Specifically, there is a dearth of empirical data regarding how imports of maize affect domestic productivity and producer welfare. The current literature also does not clearly show how the importation of maize has affected the welfare of producers and consumers. Due to these factors, assessing the overall impact of maize imports on economic welfare has proven to be challenging (Kassy et al., 2021).

To combat this issue, the study set out to understand how the importation of maize affected Kenyan consumers and producers in terms of economic welfare. Maize's abundant supply of calories has demonstrated its dominance over other food crops in Kenya. Furthermore, the consumption of other food crops has decreased while the consumption of staple foods has increased (Karagoz & Kandemir, 2023).

The availability of maize, which is the primary factor in ensuring food security, has been steadily decreasing in kilograms, even though other supply-side and demand-side factors have been increasing.

Kabugua (2023) notes that despite the significant formal and informal inflow of maize imports into Kenya through cross-border trade, the supply has not been adequate to assure Kenya of food security. According to Kiptum (2022), the population in Kenya grew from 28.7 million in 1999 to 47.6 million in 2019.
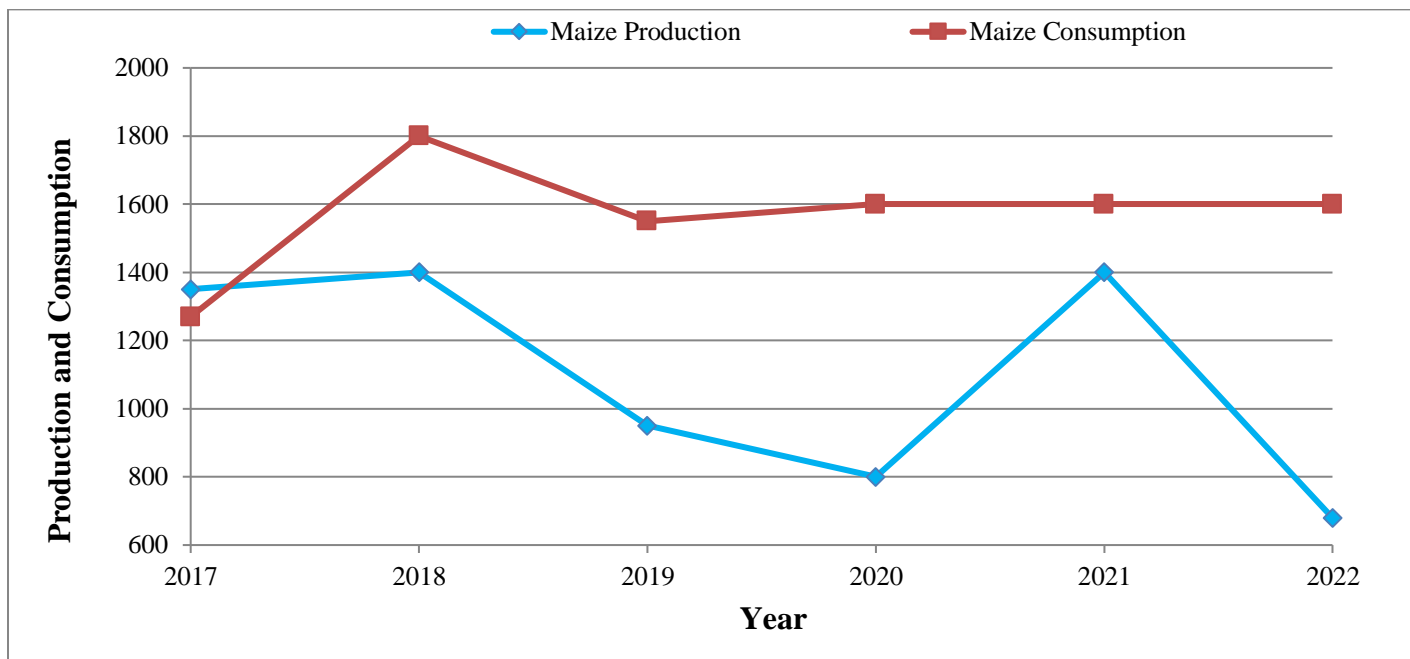
Figure 2
Production and consumption trend from 2017 to 2022
Source: Production and Consumption (2022)

Mumo (2017) further noted that the kilo-caloric maize supply declined from 750 to 648 between 1999 and 2022 (Roberts & Schlenkerl, 2009). These facts raise questions on the contribution of macroeconomic factors such as inflation, unemployment levels, national income, and international trade towards to constant deficit in maize production and food security problem. This is despite the evidence from (Pinol et al., 2021) regarding the prominence of maize as typical diet in Kenya, the efforts to increase its supply and reduce its demand failed success.

Rauch (2022) shows that the prevalence of undernourishment in Kenya was 22.4 percent in 2017, which had grown from 29.3 percent in 2022 resulting from increased food insecurity levels in Kenya. Despite several studies by (Kungu & Iraya, 2017) examining the food security and maize production situation in Kenya, it has found mixed reaction and unclear findings (Ouma et al., 2014). This makes this study significant to examine and investigate the contribution of macroeconomic factors such as inflation, unemployment levels and national income on production of maize and eventually addressing food security which is the main goal of this study and the knowledge gap this study intends to fill.

1.4 Research Objectives
This study sought to determine the following research objectives;
  i. To evaluate the role of government policies on Kenya's maize production for food security between 1992 and 2022.
 ii. To examine the relationship between inflation and maize production for food security in Kenya between 1992-2022.

1.5 Research Hypothesis
H_{O1}: There is no statistically significant effect of government policies on Kenya's maize production for food security between 1992 and 2022.
H_{O2}: There is no statistically effect on the relationship between inflation and maize production for food security in Kenya between 1992 and 2022.

II. LITERATURE REVIEW

2.1 Theoretical Literature Review
2.1.1 Food Availability Decline Theory

This theory's central claim is that a sharp decrease in the amount of food available is what leads to food insecurity. Stated differently, the theory treats the issue of food availability as being equivalent to the issue of food security. As long as it is acknowledged that a decline in the amount of food resources available is the cause of food insecurity, it ignores any current causes or circumstances that might account for the inadequate supply of food (Mahmood, 2020).

The core hypothesis of this theory is that food insecurity is caused by a steep decline in the available food supplies. In other words, the theory equates the problem of food security with the problem of food availability. It overlooks any immediate reasons or conditions that could explain the insufficient supply of food and remains plausible as long as food insecurity is accepted to be a result of a decrease in the available food resources (Mahmood, 2020).

Up until the food crisis of 1972–1973, this notion was widely accepted before both world wars. Harriet Friedmann said that between 1947 and 1972, "surplus regimes" that had enacted protectionist agricultural laws to uphold local farm prices typified the political economics of food in both Europe and the United States (Chirat et al., 2024). Agri-food relations after the war led to countries choosing to buy legislatively chosen agricultural produce at predetermined prices while enacting import restrictions and export subsidies. Food aid measures aimed at disposing of agricultural surpluses were subsequently prompted by these incentives, which finally resulted in an agricultural surplus exceeding market demand.

A 55 million-ton food shortage resulted from unfavorable weather patterns in the 1970s, which was made worse by the Soviet Union's massive demands for food imports as a result of low harvest losses (Kassy et al., 2021). The accumulating difficulties impacting supply and production ultimately caused a sudden spike in food costs. There was widespread agreement that the looming threat of hunger, starvation, and famine was caused by a drop in the global food supply because of the previous stability that had existed before the food crises of 1972–1973.

In a 1973 speech to the UN General Assembly, US Secretary of State Henry Kissinger pushed for a World Food Conference with the goal of ensuring a steady supply of food (Kassy et al., 2021).

It is noteworthy to mention that the Food Availability Fall (FAD) theory essentially states that any disruptions in food production will probably eventually result in a fall in the food supply, ignoring other immediate reasons for insufficient food supply. Accordingly, FAD implicitly includes problems like the diminishing marginal returns on land that have an impact on elements of production, especially land. Using technology and increasing inputs like labor and capital, classical economists pointed out in their analysis that, as the quantity of land is limited, the only ways to raise production are through these means, but the gains made would be marginal and would only be transient since declining returns would ultimately win out (Vos et al., 2022). Examining the available land resources is crucial, as evidenced by the law of diminishing marginal returns on offer.

Sen points out that the Malthusian Theory of Population and the FAD Theory are frequently entwined in that population growth has always been driven by the need to consume more food. Thus, hunger frequently accompanies a sharp decline in the food supply. Sen also makes the point that the FAD hypothesis works best when food consumed by a household is farmed exclusively for the household without the need for any kind of foreign trade. The ability of the household to obtain food, however, will also depend on belongings and assets like labor that can be exchanged for food if the economy permits food commerce. The entitlement thesis was developed on the basis of this concept.

Food availability refers to the supply of food, that is, the quantity of food available to a given population, which at the national level is determined by national production, national stock, and the net rate. This theory is linked to this study since the national production of maize is what will determine if the Kenyan population is receiving adequate food for its people.

2.1.2 Sen's Entitlements Theory

First published in 1981, Amartya Sen's entitlement theory offered an alternative framework for analyzing famines by redefining the issue of food security as one of demand—specifically, the inability of individuals to obtain staple foods—instead of a decline and scarcity of food supplies. Sen observed famines in Asia and Africa, concluding that a lack of food not only puts a person at risk of starvation and hunger, but also reduces their trading privileges (Kungu & Iraya, 2017).

Any alternative things, whether tangible or intangible, that a person can obtain (entitlement set) in exchange for what he currently holds lawfully (endowment set) are included (Greenwod & Hanke, 2021). Sen argues that an individual's legally recognized endowment comes from production (farming), trade (buying food), labor (producing food), and transfer (by bequest or benevolence).

According to Sen's view, the main cause of hunger, famine, and starvation is a shortage of sufficient food resources. He believed that two factors may account for food insecurity: a decrease in the value of a person's exchange entitlements or a decline in direct entitlements. These factors could include a decline in income, an increase in demand for staple foods, and a reduction in the quantity supplied. According to him, a decrease in an individual's direct entitlements or a decline in the value of their exchange entitlements might account for food insecurity. A decrease in income, an increase in the demand for staple foods, or a decrease in the quantity supplied could cause these declines. It may be brought on by a decline in income, a rise in the demand for basic foods, a decrease in the quantity supplied, an increase in food prices, or the loss of food crops to drought or flooding, respectively (Mahmood, 2022). According to the notion, entitlement failure arises when a person's set of entitlements is insufficient to prevent starvation.

From production and food availability to access and distribution, the entitlement method examined the issue of food security. Sen identified a wide range of factors that can contribute to hunger and food insecurity, of which food availability is just one. Other factors, such as decreased earnings, money-induced inflationary pressure, and failures in international trade that reduce a person's purchasing power, can also cause famine and hunger. The entitlement method and the FAD approach are really different, according to some authors, because the latter concentrates on disaggregated entitlements while the former focuses mostly on aggregated availability (Greenwood & Hanke, 2021).

2.2 Conceptual Literature Review
2.2.1 Food Security and the Transition from MDGs to SDGs

As a global initiative to fight poverty in all of its manifestations, the United Nations member states convened in New York, USA, in 2000 and adopted the United Nations Millennium Declaration. The United Nations then adopted eight broad objectives to guide the development agenda through 2015. These became known as the Millennium Development Goals (MDGs), and they consist of 18 targets and 48 indicators that make up an assessment and monitoring framework. "Target 1C: to halve the number of hungry people; captured by two indicators—the incidence of underweight children under five years old and the proportion of the population below the minimum level of dietary energy consumption" (Mechlem, 2004) - enshrined food security. "Goal 1: to eradicate extreme poverty and hunger." By 2015, it was apparent that the MDGs had become pivotal in restructuring decision-making that directed the concerted global effort against hunger.

Considerable progress has been achieved in mitigating world hunger and improving food security. Specifically, between 1990 and 2020, the proportion of undernourished individuals in developing nations decreased by about half, and the number of underweight children decreased from one in four to one in seven (Kabugua, 2023). The 2015 UN MDGs report highlighted that despite significant advancements, one in nine people worldwide still lack access to enough food, one in four children still suffer from stunting, and one in seven children are underweight. In this regard, the Ministry of Devolution and Planning of the Government of Kenya brought attention to a number of difficulties encountered in the process of attempting to achieve the MDGs. Extreme weather events and climate change were two examples. Extreme weather occurrences and climate change led to unpredictability in production levels, rapid population expansion, poor infrastructure that hampered market access, and the loss of viable agricultural land due to urbanization (Kiptum, 2022).

Since 2015, the Sustainable Development Goals (SDGs) have guided the post-2015 development agenda and have grown to be crucial points of reference for decision-makers. The 17 goals, 169 objectives, and 230 indicators that comprise the SDGs, an expansion of the MDGs, will guide the implementation of the 2030 Agenda for Sustainable Development. They are perhaps more aspirational and maintain the original focus on ending poverty; they are equally applicable to both developing and developed countries; and they are capable of combining sustainable development's environmental, social, and economic facets. Goal 2 of the agenda aims to "end hunger, achieve food security and improved nutrition, and promote sustainable agriculture" (Chirat et al., 2024). This includes a focus on food security. The Kenya Vision 2030 economic agenda links the second Sustainable Development Goal (SDG) to an average yearly economic growth rate of 10 percent.

Stated differently, the Kenya Vision 2030 designated agriculture as one of the six important sectors that together account for over half of Kenya's GDP and are anticipated to contribute to 10 percent annual growth in the country's economy (Kiptum, 2022). The Kenyan government has responded by launching a number of initiatives,

including providing funds for irrigation projects, distributing drought-tolerant crops, and subsidizing seeds and fertilizers. The Kenya 2018 "Big Four Agenda" likewise goes above and beyond in emphasizing the importance of attaining food security for the nation's development goals.

Kenya's national poverty headcount rate dropped by 13% between 2006 and 2022, with a greater decline in urban areas than rural ones, according to the 2019 SDG progress report. This indicates how near Kenya is to fulfilling Goal 2 of the SDGs. (Kiptum, 2022). Over half of the people in the six counties of Marsabit, West Pokot, Samburu, Busia, Mandera, and Turkana lacked access to food, indicating their progress toward achieving food security and ending starvation (Kiptum, 2022). Reports indicated that a further 35.8% of children, primarily residing in rural areas, experienced food poverty. According to estimations from the International Food Policy Research Institute (IFPRI), Kenya has a severe hunger problem. This is true, even though Kenya's global hunger index dropped from a concerning 36.

2.3 Empirical Literature Review

Urban et al. (2020) estimated price response efficiency for maize in Mozambique using ordinary least squares and time series analysis. For the period 1975–2000, the study used the Nerlovian adjustment type model to estimate the maize supply response to price policy. The study found that changes in the dependent variables (lagged price, area, yield, and actual rainfall) explained 62% of the variation in the harvested area, yet Mozambican farmers did not respond to incentives. Shorter policy lags and rainfall were also found not to be significant for the study period. The study, however, found that the supply of maize was sensitive to the agro-climate and traditional cropping patterns of the Mozambican farmers. The study did not consider some important variables, such as access to credit and infrastructural development.

Simatele et al. (2015) examined the effect on food production of particular structural adjustment programs (maize, millet, sorgum, groundnuts, sweet potatoes, and cassava) in Zambia. The Heckeman selection model was used in the study to estimate price elasticities, which were then used to estimate the effects of policies on the production of several food crops in Zambia. Although the study noted that the continuous increase in the exchange rate may have had a negative effect on maize production, a simulated policy effect found that freeing the exchange rate alone would lead to a meager 5.8% increase in maize output. This approach uses an actual-versus-target approach, where performance targets are set for the economy and the impact of the program is judged on how well it performs against the preset targets. 2

Own price elasticity's were found to be positive and significant for maize and groundnuts and negative for the rest of the crop. The results also showed a sluggish response in maize output to non-price factors. The conclusion was that maize, being a major staple food, was more dependent on structural variables such as information, distance to market, and credit than other crops. One weakness that was noted in the study was the fact that it used a 4-year panel of post-harvest data. Perhaps better results would have been achieved if the study period was longer (Kabugua, 2023).

Rauch (2019) looked at the impact of agricultural trade support in developed countries on maize prizes in Kenya by analyzing how prices are transmitted from OECD countries to maize prizes in Kenya. A vector auto-regression (VAR) model was used in the analysis of price transmission. A simulation of the prices of maize imports was estimated to represent the cost of maize imports if market price support and payment of output to producers were eliminated in developed countries. The study found that domestic maize prices in Kenya are affected by maize prices, which implies that these prices co-move in the long run, and therefore there was price transmission from developed countries to the domestic maize market.

The decision to study the effects of prices from OECD countries was based on the fact that 35% of total maize imports over the period 1995–2004 were from developed countries. In our opinion, this was not a significant proportion of the imports, and hence the analysis could have benefited from a comparison of the effects of prices in other regions from which the country imports maize.

There is broad agreement in the empirical literature that inflation has had a detrimental impact on global economic prosperity, affecting both industrialized and developing nations equally. On the other hand, the effects of Kenyan maize output on economic welfare are not well supported by empirical data.

The current study employed PEM to simulate welfare changes while focusing on the information

from the previously listed studies to analyze the economic welfare effects of maize production on Kenyan consumers and producers.

III. METHODOLOGY

A correlation research design was adopted in establishing the nexus between inflation and Kenya's maize production for food security. Secondary data sourced from the World Bank database and food and agriculture organization was employed. The study used quarterly data from 1990 to 2022 for the variable of interest.

3.1 Econometric Model Specification

Eviews software version 10 was used for analysis after data were gathered, cleaned, and sorted into an Excel spreadsheet. Kenya's maize production for food security was hypothesized to be correlated with inflation. The following model was employed.

$LNPMZ_t = B_o + B_1 LNINFX_{1t} + B_2 LNUNPX_{2t} + B_3 LNGDPX_{3t} + U_t$

Where: $LNPMZ_t$=Maize production for food security(t), $LNINFX_{1t}$= Inflation(t), $LNUNPX_{2t}$=Unemployment(t), $LNGDPX_{3t}$=Gross Domestic Product(t), and U=Error term.

IV. FINDINGS & DISCUSSIONS

4.1 Profile of Respondents

Table 1.displays the descriptive statistics for Kenya's maize production for food security measured by volume of maize in Tonnes proxied by CPI as a percentage of inflation .

Table 1
Profile of Respondents

Variables	LNPMZ	LNINF
Mean	14.8737	2.1302
Maximum	15.2054	3.8282
Minimum	14.5522	0.4410
Std.Dev	0.1937	0.7006
Skewness	-0.0633	0.0362
Kurtosis	1.7486	3.8860
Jarque-Berra	1.9777	0.9878
Probability	0.3720	0.6102
Observation	30	30

Source: Author (2024)

Table 1 indicates that Kenya's maize production LNMPZ had a mean of 14.87%; which is below the envisioned 36% by vision 2030 (Pinol et al., 2021) Indicating the Maize production sector has not achieved its full potential. Additionally inflation proxied as a percentage of CPI has a mean of 2.13%,which according to the world bank 2020.inflation rate as proportioned by CPI was fluctuating from one quarter to another same as the volume of maize production for food security in tonnes (Heady et al.,2008).

4.2 Augmented Dickey –Fuller unit Root Test

Since most statistical models and procedures assume that the underlying data is stationary, it is imperative to confirm the existence of a unit root before conducting any statistical analysis in order to avoid producing incorrect results (Gujarat, 2022). The augmented Dickey Fuller ADF test was used in this investigation to look for unit roots. Inflation was stationary at level, while maize production for food security LNMPZ was stationary at first difference.

Table 2
Shows ADF Test Results

variables	ADF Test statistic at level	Critical value at 5%	ADF Test statistic at 1st difference	Critical value at 5%	Integration order
LNMPZ	-2.390991	-2.9571	-7.3103	-2.9604	1st difference
LNINF	-4.1002	-2.9571	-	-	level

Source: Author (2024)

4.3 F-Bound Cointegration Test

The ARDL bounds test was adopted in checking for cointegration since the variable exhibited mixed integrated order (Tursoy & Faisal, 2018).

Table 3
Displays the F-Bounds Cointegration Test Results

Test statistic	Value	significant	1(0)	1(!)
F-statistic	2.6656	10%	3.47	4..45
K	3	5%	4.01	5.07
		2.5%	4.52	5.62
		1%	5.17	6.36

Source: Author (2024)

Table 3 shows that, at a 5% significant level, the researcher was unable to reject the null hypothesis since the Bound test's F-statistic (2.6656) was less than the crucial values of 1(0) and 1(1) at 5%, or 4.01 and 5.07, respectively; demonstrating the lack of a long-run relationship between the variable being studied.

4.4 Regression Results

A multivariate regression analysis was used to determine the relationship between maize production for food security and inflation .table 4 shows the results of the regression analysis

Regression results
Dependent variable: DLNPMZ
Method: Least Squares
Sample (adjusted): 2 33
Included observation: 30 after adjustments:

Table 4
Regression results test

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNINF	-0.153125	0.037106	-4.126669	0.0002
DLNUNP	-0.261843	0.107761	-2.429842	0.0036
LNGDP	0.136665	0.030573	4.470044	0.0001
C	14.66542	0.204282	71.78995	0.0000
R-squared	0.588279	Mean dependent var		14.87371
Adjusted R-squared	0.529234	S.D. dependent var		0.193732
S.E. of regression	0.146363	Akaike info criterion		-0.881888
Sum squared resid	0.356975	Schwarz criterion		-0.695062
Log likelihood	17.22832	Hannan-Quinn criter.		-0.822121
F-statistic	8.269651	Durbin-Watson stat		1.785930
Prob (F-statistic)	0.000500			

Source: Author (2024)

Table 4 indicates that the measure of goodness of fit (R^2)Value of 0.588279 and the probability value of F – statistic was 0.000500 <0.05 implying the fitness and statistical significance of the regression model at 5% level of significance .Furthermore ,R^2 of 0.588279 implied that the variance in the maize production for food security was predicted by a variance of 58.83% in the explanatory variables. The regression equation obtained from table 4 is:

$LNPMZ_t = 14.66542 - 0.153125 LNINF_t - 0.261843 LNUNP_t, +0.136665 LNGDP_t, +U_t$

Where:

$LNPMZ_t$ = Maize production for food security in Kenya

$LNINF_t$ = Inflation Rate

$LNUNP_t$ = unemployment rate

U = the error term

T = quarterly time series

4.4.1. Results Interpretation

From table 4 Inflation has a significant negative effect on maize production for food security with a p-value of 0.0002 < 0.05 and a coefficient BO of -0.153125 showing that one- percentage increase in inflation decreases the performance of Kenya's maize production for food security by 15.31%,when all other factors are held constant.

The finding agrees with Dercon and Krishnan (2000) study .The study conducted in Zambia found that high inflation rates led to decrease in maize production due to increased production costs and reduced farmers 'purchasing power.

4.5 Post Estimation Diagnostic Tests
4.5.1 Normality Test

The study adopted the Jarque –Berra test in checking if the regression residuals were normally distributed.

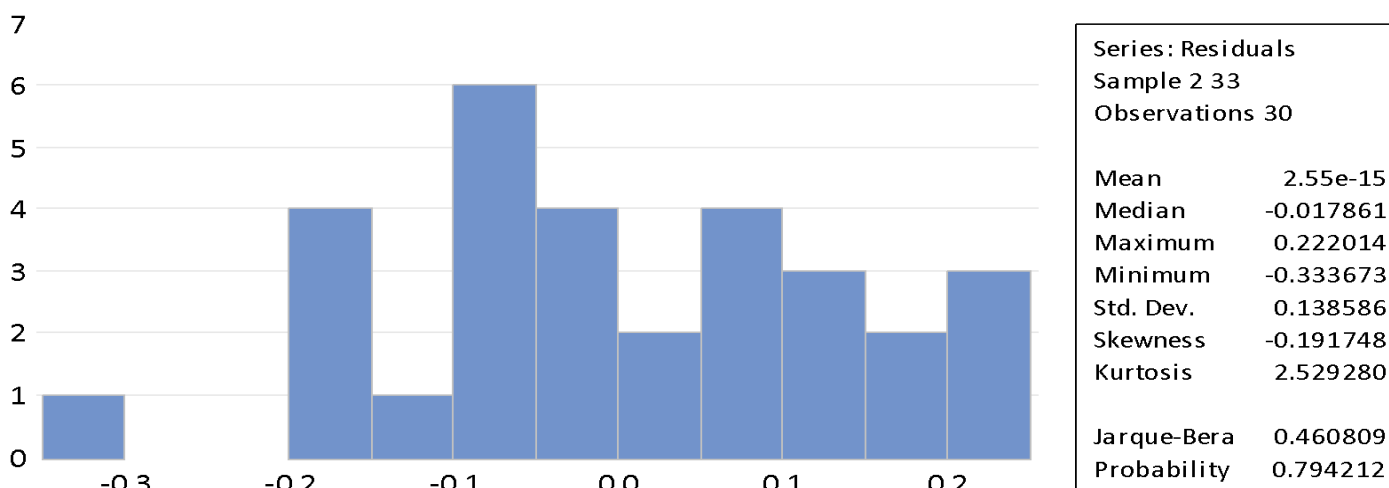| Series: Residuals	
Sample 2 33	
Observations 30	
Mean	2.55e-15
Median	-0.017861
Maximum	0.222014
Minimum	-0.333673
Std. Dev.	0.138586
Skewness	-0.191748
Kurtosis	2.529280
Jarque-Bera	0.460809
Probability	0.794212

Figure 3

Jarque–Berra Test Output for Normality

Source: Author (2024)

The result in Figure 1 shows that the jarque-Berra p-value of 0.794212 greater than 0.05,implying that regression residuals were distributed normally.

4.5.2 Multicollinearity Test

According to Gogtay and Thatte (2017), the output of the variance inflation factors test used to check for multicollinearity is shown in Table 5. A VIF value of less than 10 shows that multicollinearity is not present in the regression model.

Table 5
Variance Inflation Factor Multicollinearity Test

	Coefficient	Uncentered	Centered
Variable	Variance	VIF	VIF
LNINF	0.001759	12.34648	1.168876
DLNUNP	0.020700	41.10495	1.028177
LNGDP	0.000935	2.687085	1.17485
C	0.041731	58.44137	NA

Source: Author (2024).

Table 5 shows that the VIF values of LNINF,DLNUNP, and LNGDP are 1.168876, 1.028177 and 1.17485 respectively .The above VIF values were less than 10 ,thus implying there was no multicollinearity in the regression model.

4.5.3 Breusch –Pagan –Godfrey Heteroscedasticity Test
As per Gujarati (2022), the regressor error terms in a model are considered presumptively homoscedastic, indicating that their variance remains constant. Table 6 presents the results of the Breusch-Pagan-Godfrey heteroscedasticity test, which was utilized to verify the existence of heteroscedasticity in the data.

Table 6
Breusch-Pagan –Godfrey Heteroscedasticity Test

F-statistic	0.561218	Prob. F(3,36)	0.6454
Obs*R-squared	1.824529	Prob. Chi-Square(3)	0.6096
Scaled explained SS	**1.047881**	**Prob. Chi-Square(3)**	**0.7897**

Source: Author (2024).

It can be shown from table 6 that there was no heteroscedasticity because the observed R –squared probability was greater than 0.05.

4.5.4 Breusch –Godfrey –Autocorrelation Test
The Breusch-Godfrey Test was used in the study to look for autocorrelation. The results of the Breusch-Godfrey Test for Autocorrelation are shown in Table 7.

Table 7
Breusch-Godfrey Autocorrelation Test

Breusch- Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	5.581188	Prob.F (2,24)	0.7910
Obs*R-squared	9.523569	Prob.Chi-Square (2)	0.0565

Source: Author (2024)

The results of the breusch-Godfrey test in Table 7 indicates that the p-value of Chi-square was 0.0565 greater than 0.05 implying that the model was not affected by autocorrelation.

V. CONCLUSIONS & RECOMMENDATIONS

5.1 Conclusion
The study examined the nexus between Inflation and Kenya's maize production for food security .Employing quarterly data from 1992-2022.Findings from regression output revealed Inflation had a negative significant effect on Kenya's maize production for food security .with regression coefficient of -0.153125 and a p-value of 0.0002 less than 0.05.The study concludes that inflation rates moderately lower the Kenya's maize production for food security.

5.2 Recommendations

Kenya's government must manage the country's inflation rate. The government should enact monetary and fiscal policies targeted at reducing inflation rates through actions including modifying interest rates, limiting the money supply, and exercising fiscal restraint in order to lessen the impact of inflation on the performance of the farm sector. It is recommended that the Kenyan government use price stability measures, including buffer stocks, strategic reserves, and commodity price supports, in order to protect farmers from erratic market prices.

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